PCT WORLD INTELLECTUAL PR
Internationa

INTERNATIONAL APPLICATION PUBLISHED UND

WO 9608020A1

(51) International Patent Classification 6 :
H01B 3/48

A1

(11) International Publication Number: **WO 96/08020**

(43) International Publication Date: 14 March 1996 (14.03.96)

(21) International Application Number: PCT/SE95/00978

(22) International Filing Date: 31 August 1995 (31.08.95)

(30) Priority Data:
9402933-7 5 September 1994 (05.09.94) SE

(71) Applicant: ASEA BROWN BOVERI AB [SE/SE]; S-721 83 Västerås (SE).

(72) Inventors: BACKA, Stefan; Regementsgatan 5, S-723 45 Västerås (SE). TORNBERG, Lars; Barkassgatan 1, S-371 32 Karlskrona (SE). WORZYK, Thomas; Idrottsstigen 6, S-370 30 Rödeby (SE).

(74) Agents: LUNDBLAD VANNESJÖ, Katarina et al.; Asea Brown Boveri AB, Patent, S-721 78 Västerås (SE).

(81) Designated States: JP, NO, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
In English translation (filed in Swedish).

(54) Title: ELECTRIC DEVICE

(57) Abstract

An electric device comprising at least one or more current- or voltage-carrying bodies, conductors. The conductors are at least partially arranged with an electrical insulation comprising cellulose fibres with dielectric strength and impregnated with an electrically insulating fluid. The insulation has been formed starting from an insulating mass comprising cellulose-based fibres dispersed in the electrically insulating fluid and which is mouldable under the conditions prevailing during application and forming.

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Electric device

TECHNICAL FIELD

The present invention relates to an electric device which at least comprises one or more current- or voltage-carrying bodies, conductors, and an electrical insulation, arranged between or around these conductors, in the form of a cellulose-based fibre-containing insulation.

BACKGROUND ART

Electric devices such as high-voltage cables, transformers, generators etc., comprise current- and voltage-carrying bodies, conductors, and an electrical insulation arranged between and/or around these conductors. For high voltages, above 100 kV, there are substantially used cellulose-based or polymeric insulating material for this insulation.

Polymeric materials such as polyethylene, PE, ethylene-propylene rubber, EPDM, are used to advantage in, for example, cables. They are characterized by great flexibility and a possibility of being applied on the conductors included in the cable by means of extrusion, which permits a high rate of production. Further, polymeric materials, and in particular PE, have a very high mass resistivity, whereby leakage currents through the insulation become extremely small; however, the mass resistivity is greatly dependent on temperature and also dependent on inclusions or other inhomogeneities in the material. However, polymeric materials are not used commercially as insulation in devices included in transmission networks for high-voltage direct current since in these applications the field distribution is controlled by the resistivity of the insulating material and the resistivity in the insulation may vary. This can lead to very unevenly distributed fields when using polymeric insulations for high-voltage devices.

Conventional cellulose-based electrical insulations consist of wound, spun, layers of paper tape or of preformed bodies manufactured by dewatering and/or pressing of a fibre mass, for example pressboard. Both wound and preformed insulations are impregnated with an electrically insulating fluid, usually an organic fluid such as oil, prior to, in connection with, or after the application. The active part of the insulation is the paper, which is protected against moisture by the impregnation while at the same time the impregnation fills the voids between the cellulose fibres, whereby the dielectrically weak air in the voids between the fibres is replaced by oil. In this application, cellulose fibres mean pulp fibres which contain cellulose and, to a varying extent, lignin and hemicellulose.

The application of these cellulose-based insulations around or between the above-mentioned conductors is performed by means of very time-consuming processes that demand a great deal of work, comprising paper cutting, winding, alternatively forming/pressing in case of preformed insulations as pressboard. Conventional cellulose-based insulations need to be dried and impregnated to attain a high dielectric strength. In case of large apparatuses, these processes take very long time and since, in addition, the process is discontinuous, the complexity and hence time expenditure are further increased.

From British patent document GB,A,1 282 049, it is known to improve the electric properties of a cellulose-based insulation by introducing synthetic spheres of a thermoplastic polymer into a fabric of cellulose fibres before this fabric is formed into a continuous tape which is applied to a conductor. The tape may either be applied around the conductor in connection with the forming and dewatering of the continuous paper tape, or by winding a paper tape, in which thermoplastic spheres have been introduced, onto the conductor. As in the above-described processes for application and impregnation of cellulose-based insulations, this insulation, after having been applied to the conductor, must be dried and impregnated

with an electrically insulating fluid in time-consuming operations to attain the high dielectric strength which is required of insulations included in insulated high-voltage devices.

It is an object of the invention to suggest an electric device with an electrical insulation in the form of at least one insulating body comprising at least cellulose fibres and impregnated with an electrically insulating liquid. By liquid is meant a fluid which, under the conditions prevailing during the forming, is a liquid and which is essentially non-polymerized. After the forming, the liquid may change into solid state. This liquid fills essentially all pores and voids present in the fibrous insulation. The fibrous insulation is applied around the conductor by means of a fast and reliable process and exhibits the high dielectric strength which is required of insulations included in insulated high-voltage devices without having undergone, during the manufacturing process, the time-consuming impregnation operations as for known cellulose-based insulations. In an electric device according to the invention, the electrical insulation, which at least comprises cellulose fibres impregnated with an electrically insulating fluid, may be applied and formed around the conductors, for example during mounting or repair, as, for example, during cable jointing and other types of installations and repair work in the field.

SUMMARY OF THE INVENTION

This has been achieved for an electric device with one or more current- or voltage-carrying bodies, conductors, which at least in part have been supplied with an insulation in the form of at least one insulating body of cellulose-based fibres and impregnated with an electrically insulating fluid, by applying the impregnated cellulose insulation to the conductor, according to the invention, and forming it, preferably by means of injection moulding or extrusion of an electrically insulating mass which is mouldable under the conditions

prevailing during application and forming. This insulating mass comprises dielectric-strength cellulose fibres dispersed in an electrically insulating fluid which, under the conditions prevailing during application and forming, is liquid. In addition to the cellulose-based fibres, the fibrous insulation consists at least of an electrically insulating fluid, preferably a hydrocarbon-based liquid, such as a viscous mineral oil. By liquid is meant a fluid which, under the conditions prevailing during the forming, is a liquid and which is essentially non-polymerized. After the forming, the liquid may change into solid state. This liquid essentially fills all the pores and voids present in the fibrous insulation and constitutes during the forming/extrusion an incompressible medium in which the cellulose fibres are dispersed. The cellulose in the cellulose fibres is at least partially transformed into cellulose derivate. By cellulose derivate is meant in this application cellulose for which hydrogen included in hydroxyl groups has been at least partially replaced by other groups, for example aromatic groups or alkyl groups such as benzyl groups. According to a basic process, cellulose in the form of particles or fibres is pretreated in a basic solution, whereby the cellulose swells and is activated. Thereafter, compounds such as organic halogenides, epoxy compounds or acid chloride are added and are allowed to react with the cellulose. The cellulose, which after the reaction at least partially comprises cellulose derivate, is washed and dried before being supplied to and dispersed in the above-mentioned insulating liquid. According to an alternative acid process, cellulose in the form of fibres or particles is mixed with an organic acid in the presence of an acid catalyst such as trifluoro acetic acid. The acid process may be performed in an organic solvent. After reaction, the cellulose, which now at least partially contains cellulose derivate, is washed and dried before being supplied to and dispersed in the insulating liquid. Cellulose fibres containing cellulose derivate and suitable for this use may also be obtained by means of other processes such as grafting.

The electric device according to the invention preferably comprises a fibrous insulation which is formed from an insulating mass which comprises at least modified cellulose fibres with dielectric strength and dispersed in an electrically insulating liquid, preferably a viscous mineral oil.

When preparing the insulating mass, additions have been made, where necessary, to attain a good dispersion of cellulose fibres in the insulating liquid and to ensure that the insulating liquid wets the fibres. There are advantageously used cellulose fibres which have been modified by a pretreatment according to the above and thus, at least partially, comprise cellulose derivate. In this way it is ensured that the insulating mass exhibits the desirable mechanical and dielectric properties during application as well as during use. The insulating mass or its constituents have suitably been dried and degassed to remove moisture and gases before it is applied around the conductors in an electric device according to the invention. The percentage of fibres and the fibre composition, for example the percentage of modified cellulose fibres, has been optimized to improve the dielectric properties while at the same time the good mechanical strength is maintained or improved. In order to avoid inhomogeneities, such as fibre clusters or cavities in the insulation, a good dispersion of fibres in insulating liquid is required and also that the insulating liquid wets the fibres and fills all the voids between the individual fibres. This is achieved, for example, by modifying the cellulose according to the above described pretreatment, before being supplied to and dispersed in the insulating liquid. Alternatively, or as a complement to the pretreatment, additives may have been supplied to the fibres or the insulating liquid. Such additives influence chemical and physical conditions in the boundary layer between fibres and insulating medium, the viscosity of the insulating medium/insulating mass, and/or bring about a chemical or physical bond of the cellulose fibres into a network. The presence of inhomogeneities in the insulation gives rise to disturbances in the electric field strength distribution in

case of electric loading and must, therefore, be avoided to eliminate a degradation of the insulation associated therewith, for example as a result of internal corona.

A fibre insulation with cellulose-based fibres impregnated by an electrically insulating liquid according to the invention is extrudable during the application but exhibits sufficient mechanical stability and good electrical properties under the normal conditions of use of the electric device. According to one embodiment of the invention, this combination of mouldability during the application and mechanical strength/resistance to deformation under the conditions of use of the device is achieved in that the cellulose-based fibrous insulating mass impregnated with insulating liquid exhibits a temperature-dependent viscosity. The insulating mass has thereby been extruded at an elevated temperature where the insulating mass was mouldable and then it has solidified during cooling in order to constitute an insulation which is resistant to deformation and has sufficient mechanical strength when being used at the normally prevailing temperatures. The temperature dependence of the viscosity of the insulating mass has been guided by the choice of insulating liquid and/or by additives which influence the viscosity of the cellulose-based insulating mass. In another embodiment of the invention, a shear-thinning insulating mass has been used. By the addition of shear forces during and in connection with the application/forming of the mass around the conductors included in the invented device, the mass has been made less viscous. Thereafter, resistance to deformation has been imparted to the mass to form an insulation with the required mechanical strength.

An increase of the mechanical strength and the resistance to deformation of an insulation in a device according to the invention after the application/forming is obtained in another embodiment by forming the insulation by means of a forming process where insulating liquid has been removed from the insulation/insulating mass during or in connection with the

application and forming of the insulation around a conductor included in the device. When insulating liquid is removed, the percentage of fibres is increased and the impregnated cellulose-based insulation thus obtained has been given a higher percentage of fibre in relation to the insulating mass and a cross linking of the fibres. This cross linking has preferably arisen by increasing the contact between the fibres and bonding the fibres to each other by physical and/or chemical bonds. The insulation in a device according to this embodiment of the invention exhibits an essentially non-reversible resistance to deformation. Insulating liquid may be removed with a number of techniques such as by being pressed out of the insulation/the insulating mass or by partially volatilizing it and driving it off by an increase in temperature during or in connection with the application/forming.

According to another embodiment of the invention, the device comprises an impregnated cellulose-based insulation where an insulating mass with a temperature-dependent viscosity is formed by means of a forming process where insulating liquid is removed from the insulating mass in or in connection with the application and forming of the insulation in order to reinforce and render the resistance to mechanical deformation of the insulation non-reversible.

According to still another embodiment, the device comprises an impregnated cellulose-based insulation where the bonding or cross linking of the fibres has been further reinforced by supplying additives such as cellulose acetate to the insulating mass or by modifying the surface of the fibres. For example, the hydroxide groups on the surface of the cellulose fibres have been completely or partially replaced by non-polar groups to increase the wettability.

As insulating liquid a mineral oil has preferably been described, but this may be replaced by other liquids which exhibit the necessary dielectric properties, stability to degradation under the conditions of use, and by means of which

the necessary floatability may be achieved in the insulating mass during application and forming while at the same time this mass may form, together with the cellulose fibres and any additives, an insulation which is resistant to deformation and which has the necessary electrical and mechanical properties under normal conditions of use. It is advantageous if the insulation obtained exhibits a sufficient mechanical flexibility to be able elastically to follow movements and expansion/contraction of electric conductors and other live bodies or layers which are included in the device and with which it makes contact during use, for example as a result of temperature fluctuations.

The task of any additives added to the insulating liquid and/or the insulating mass or applied to the cellulose fibres is as follows:

- to impart to the cellulose fibres suitable thermoplastic properties,

- to disperse the cellulose fibres in the insulating liquid and ensure that no flocks of fibres are formed,

- to ensure that the fibre surfaces are wetted by the insulating liquid and that no gas-filled voids remain between the fibres.

In certain cases, additional substances are also desired which:

- modify the surfaces of the cellulose fibres chemically or physically, for example to increase the degree of bonding of the fibres and hence the mechanical strength of the formed cellulose-based insulation impregnated with insulating liquid,

- influence the viscosity of the insulating liquid, for example to make it less viscous during the application.

The additives used are not allowed to have a negative influence on the dielectric properties of the impregnated cellulose-based insulation, nor on its stability relative to degradation as a result of electrical, thermal or other loading. Where necessary, substances such as antioxidants, voltage stabilizers, etc., have been added to the insulating mass, which substances stabilize the mass against oxidation or other influence from external factors such as electric or magnetic fields as well as heat or other radiation. The additives must not result in the insulating liquid being polymerized.

EXAMPLES

In the following the invention will be exemplified based on a number of examples. An example of pretreatment of cellulose fibres, which are included in a preferred form of the invention, will first be given. Then follows a description of how mc ldable/injectable insulating masses with dielectric strength are prepared from cellulose-based fibres. The mouldable insulating masses, especially at a low degree of substitution, may comprise an electrically insulating liquid in which the fibres have been dispersed. In addition, the examples below describe how cellulose-based fibre masses are formed into electrical insulations included in electric devices according to the invention.

Pretreatment of cellulose fibres

A wood meal of, for example, birch and with a grain size less than 500 µm was introduced into a container with nitrogen atmosphere and mixed at room temperature with a caustic soda solution which has a content of 44 per cent by weight caustic soda. The mixture was stirred continuously by means of a mechanical stirrer. After an hour the temperature was raised to 100°C and benzyl chloride was added in two equally large portion at 45 minutes' interval. In total, the same quantity of benzyl chloride was added as caustic soda. After a total

reaction time of 4 hours under continuous stirring, the reaction was interrupted by an addition of glacial acetic acid. Thereafter, the cellulose was washed with methane alcohol, boiled for 2 hours in water and dialysed against water for 48 hours before it was dried under vacuum at 70°C for 48 hours. Benzylated cellulose can then be prepared into an extrudable insulating mass. In the following examples, insulating masses with cellulose fibres comprising cellulose derivates and dispersed into an electrically insulating liquid will be described.

High-voltage cable

A high-voltage cable according to the invention comprises at lest one or more electric conductors and an electrical insulation around and/or between the conductor or conductors. This insulation comprises, at least in part, an impregnated cellulose-based insulation comprising cellulose fibres with dielectric strength dispersed in an electrically insulating liquid and any additional substances. Preferably, this insulation has been applied and formed around and/or between the conductors in the form of a mouldable mass. This insulating mass has preferably been prepared according to the below and has, during or in connection with its application/forming around a conductor, been transformed into an insulation resistant to deformation. This insulation exhibits the necessary electrical and mechanical properties as well as stability to degradation as a result of the thermal, mechanical, electrical or other influence to which a high-voltage cable is subjected during installation and use. A cable insulation usually also includes one or more semiconductive layers, the task of which is to equalize the electrical voltage gradient in certain of the boundaries of the insulation. In certain embodiments, also these semiconductive layers are arranged in the form of a cellulose-based fibrous material to which, during the preparation according to the above, a semiconductive or conductive substance, such as soot, has been added.

When manufacturing a cable according to the invention, one or more of the layers applied around the conductor or conductors have been applied by extrusion of an insulating mass prepared according to the following:

Prior to the extrusion, an insulating mass, which is mouldable under the conditions prevailing during the extrusion, has been prepared. The insulating mass or its constituents has/have been dried and degassed. This mouldable insulating mass comprises at least

- cellulose fibres with dielectric strength, preferably in the form of cellulose fibres modified according to the above-described pretreatment but also other cellulose fibres which exhibit suitable dielectric and mechanical properties may be included, as well as mixtures of two or more types of cellulose fibres,
- an electrically insulating fluid, which under the conditions prevailing during the application is liquid, such as a viscous mineral oil, and
- any additional substances, which have been added to the insulating fluid and/or applied to the fibres to ensure that the cellulose fibres are dispersed in the insulating fluid and that no flocks of cellulose fibres remain or are formed and/or that the surface of the cellulose fibres is wetted by the insulating fluid and that no gas-filled voids remain between the fibres.

In certain cases, additives are also desired which modify the surfaces of the cellulose fibres chemically or physically, for example to increase the degree of bonding of the fibres and hence the mechanical strength of the insulation and/or influence the viscosity of the insulating medium, for example to make it less viscous during the application,
and which do not have any negative influence on the dielectric properties of the impregnated cellulose-based insulation, nor on its stability in relation to degradation as a result of electrical, thermal or other loading. When preparing a mouldable semiconductive mass, a conductive/semiconductive,

preferably particular substance, such as soot, is also added and dispersed.

A cable for transmission of high-voltage direct current according to the invention comprises conductors in the form of one or more metal wires around which is applied a triple layer consisting of:
- an inner semiconductive layer to equalize the potential of the conductor at the boundary, in the form of a semiconductive mass in accordance with the semiconductive mass previously described for the high-voltage cable and with addition of soot or as wound soot paper,
- an insulating layer with a composition according to the insulating mass described for the high-voltage cable and of the necessary thickness, and
- an outer semiconductive layer with the same or a similar composition as the inner semiconductive layer, wherein at least the insulating layer consists of an impregnated cellulose-based insulating mass which has at least partially been prepared according to the above and applied and formed by extrusion.

Cable termination

A cable termination according to the prior art is built up around a cable end where the conductor has been stripped and the cable end provided with an insulating body, for example consisting of wound paper. The shape of the insulating body has been calculated for optimizing the electric field which arises near the cable termination. The insulating body is arranged enclosed in a casing of, for example, porcelain and is impregnated with an insulating oil. When the end termination has been built up in the field, the requirements and costs for avoiding contamination with moisture, etc. increase.

A cable termination according to the invention is built up around an exposed cable insulation, around which an insulation comprising at least cellulose fibres with dielectric strength

dispersed in an electric mineral oil is formed. The insulation has a composition which essentially corresponds to the insulating layer in the previously described high-voltage cable and has been applied in the form of a mouldable insulating mass. This insulating mass has been mixed and prepared in accordance with the description given above for the example of a high-voltage cable, and after drying and degassing it has been applied directly around the exposed cable insulation. During the application/forming, the mouldable insulating mass has been pressed into a press mould arranged around the cable end and been formed into an optimum shape from the electrical point of view. The insulating mass has preferably been mixed, dried and degassed in the factory before being shipped to the site of installation. After the removal of the press mould, an external insulation such as a ceramic insulator body has been applied and filled with an appropriate oil, which fills up the entire volume between the insulating body according to the invention and the external insulation. Alternatively, the external insulator has constituted the press mould during the forming of the insulating body and is then allowed to remain, and in that case normally no extra addition of oil is necessary in addition to the oil which is present in the fibre-based insulating mass.

The risks of a cable termination, which is insulated according to the above, being contaminated or of other defects being introduced because of the influence of external factors have been reduced in relation to an insulation built up according to the prior art, while at the same time the manufacturing time and the manufacturing costs have been greatly reduced.

Cable joint

When joining conventionally paper-insulated cables, the cable ends are stripped conically and then, after the cable ends have been joined together, a new insulation is applied thereto by:

- winding on a new paper insulation into the required dimension,
- impregnation of the wound-on paper insulation,

whereupon the sheath and the reinforcement are taken care of. This is a time-consuming and sensitive process.

A cable joint according to the invention is achieved in a fast, simple and reliable manner by applying, after the conductor welding, a press mould over the joint whereupon a mouldable impregnated cellulose-based insulating mass is pressed into the press mould to form an insulation with an optimum shape from an electrical point of view and with the required dielectric and mechanical properties, whereupon the sheath and the reinforcement are taken care of. The cellulose-based fibre mass has a composition and has been prepared according to the previous example relating to a high-voltage cable. The risk of contamination and the occurrence of other defects, caused by external factors, when building up a cable joint according to the invention is greatly reduced relative to a conventional cable joint. Also, the time for building up the cable joint is essentially reduced without lowering the requirements for the performance of the joint. As when building up cable terminations in the field, additional advantages from the point of view of handling and quality have been achieved by preparing, drying and degassing the insulating mass prior to the shipping to the installation site.

Winding for current transformer

In certain types of current transformers, the primary winding consists of a strong conductor which has the shape of a hair pin with an extended loop in which the transformer core is placed. In this way, the conductor forms half a turn around the transformer core. Around this conductor, an insulating winding of paper is applied. The winding of the paper is time-consuming due to the shape of the conductor. An impregnated cellulose-based insulation for a current transformer according to the invention is applied by applying a press mould with a

shape suitable for the purpose around the conductor, whereupon the space between the press mould and the conductor is filled, under overpressure, with a mouldable insulating mass consisting of at least cellulose fibre and an electrically insulating liquid. The insulating mass then forms an optimum insulating body from an electrical point of view. Prior to the forming, the insulating mass has been prepared under controlled conditions and the constituents included have been dried and degassed, preferably in a room suitable for this purpose.

CLAIMS

1. An electric device comprising at least one or more current- or voltage-carrying bodies, conductors, which at least partially are arranged with an electrical insulation comprising at least cellulose fibres with dielectric strength and impregnated with an electrically insulating fluid, **characterized** in that said insulation has been formed starting from an insulating mass comprising at least cellulose-based fibres dispersed in said electrically insulating fluid and which is mouldable under the conditions prevailing during application and forming.

2. An electric device according to claim 1, **characterized** in that said impregnated cellulose-based electrical insulation has been formed by means of injection moulding or extrusion of an electrically insulating mass, which is mouldable under the conditions prevailing during application and forming and which at least comprises cellulose fibres with dielectric strength and dispersed in an electrically insulating fluid.

3. An electric device according to claim 1 or claim 2, **characterized** in that the viscosity of said insulating mass is temperature-dependent and that the viscosity of the mass in connection with or after the application and the forming has been raised by a temperature change of the mouldable insulating mass, whereby a resistance to deformation, which is necessary for use, has been imparted to the impregnated cellulose-based insulation.

4. An electric device according to claim 1 or claim 2, **characterized** in that the cellulose-based insulating mass is shear-thinning, whereby, in connection with application and forming, it has been rendered mouldable by the application of shear forces.

5. An electric device according to any of the preceding claims, **characterized** in that the mechanical strength and the resistance to deformation of said cellulose-based insulation have been raised by increasing the percentage of fibre in the formed insulation in relation to the insulating mass in connection with or after the application and forming of the insulating mass.

6. An electric device according to any of the preceding claims, **characterized** in that said electrically insulating fluid is based on a viscous mineral oil.

7. An electric device according to any of the preceding claims, **characterized** in that said electrically insulating fluid is based on a synthetically produced viscous organic fluid.

8. An electric device according to any of the preceding claims, **characterized** in that the hydroxide groups of said cellulose fibres are, at least partially, replaced.

9. An electric device according to claim 8, **characterized** in that said cellulose fibres are bonded together in a network by means of chemical and/or physical bonds.

10. An electric device according to any of the preceding claims, **characterized** in that said impregnated cellulose-based electrical insulation comprises cellulose fibres which have been modified and, at least partially, comprise cellulose derivate.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 95/00978

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: H01B 3/48
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: H01B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI, CLAIMS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 1282049 A (THE DOW CHEMICAL COMPANY), 19 July 1972 (19.07.72) --	1-10
A	EP 0304785 A2 (BAYER AG), 1 March 1989 (01.03.89) --	1-10
A	Dialog Information Service, File 351 World Patent Index 81-95, Dialog accession no. 009169431, WPI accession no. 92-296865/36, HITACHI CABLE LTD: "High expansion ratio foamed polyethylene small dia. wire mfr. - by foam extrudingpolyethylene contg. short fluoro--plastic fibres on a conductor or conductor shield layer, giving wires less likely to collapse". JP 4206407, A, 920728, 9236 (Basic) --	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search	Date of mailing of the international search report
8 December 1995	20 -12- 1995
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Ingrid Falk Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT 30/10/95

International application No.
PCT/SE 95/00978

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A- 1282049	19/07/72	NONE	
EP-A2- 0304785	01/03/89	DE-A- 3728301	09/03/89
		DE-D- 3884525	00/00/00
		JP-A- 1069658	15/03/89
		US-A- 5234984	10/08/93

Form PCT/ISA/210 (patent family annex) (July 1992)